

- 1 1. A network comprising:
2
3 a signal source apparatus to provide information;
4
5 electromagnetic radiation generator capable of being modulated for
6 providing electromagnetic radiation comprising non-visible
7 radiation;
8
9 electronic circuitry for modulating the electromagnetic radiation
10 generator;
11
12 medium through which the electromagnetic radiation passes and is
13 transmitted;
14
15 receiver apparatus for receiving and demodulating the modulated
16 electromagnetic radiation;
17
18 first user means for processing and making use of the information to
19 achieve a useful functional purpose; and
20
21 second user means for achieving a useful functional purpose from said
22 non-visible radiation said useful functional purpose being different
23 from the purpose of said first user means.
24
- 25 2. The network of claim 1 in which the useful functional purpose of either the first
26 user means or the second user means comprises communication.
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- 28 3. The network of claim 1 in which the useful functional purpose of neither the first
29 user means nor the second user means comprises communication.

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- 2 4. The network of claim 1 in which the wavelength range of said non-visible
- 3 radiation comprises the ultraviolet range.
- 4
- 5 5. The network of claim 1 in which the wavelength range of said non-visible
- 6 radiation comprises the infrared range.
- 7
- 8 6. The network of claim 1 in which the wavelength range of said non-visible
- 9 radiation comprises the radio frequency range.
- 10
- 11 7. The network of claim 1 in which the wavelength range of said non-visible
- 12 radiation comprises the microwave range.
- 13
- 14 8. A method of determining a location at a structure, which comprises:
- 15
- 16 providing a lighting infrastructure having transmitters each optically
- 17 transmitting a respective relative position of that transmitter with
- 18 respect to a fixed position;
- 19
- 20 detecting the respective relative position of at least one of the transmitters
- 21 with an optical receiver; and
- 22
- 23 determining a relative position of the receiver from the detected relative
- 24 position.
- 25
- 26 9. The method according to claim 8, wherein the transmitters are selected from the
- 27 group consisting of ultraviolet, infrared, and visible emission devices in the
- 28 lighting infrastructure.
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- 1 10. The method according to claim 8, which further comprises performing the step of
2 determining the relative position of the receiver by determining a two-
3 dimensional position of the receiver relative to at least one of the detected
4 transmitters.
5
- 6 11. The method according to claim 8, which further comprises performing the step of
7 determining the relative position of the receiver by determining a three-
8 dimensional position of the receiver relative to at least one of the detected
9 transmitters.
10
- 11 12. The method according to claim 8, which further comprises performing the step of
12 determining the relative position of the receiver by comparing a received signal
13 strength of at least one of the detected transmitters with a transmitted signal
14 strength.
15
- 16 13. The method according to claim 8, which further comprises synchronously
17 transmitting the respective relative position of the transmitters from the
18 transmitters.
19
- 20 14. The method according to claim 8, which further comprises performing the step of
21 determining the relative position of the receiver by transmitting the relative
22 position of the detected transmitters to a central station and determining the
23 receiver's position with the central station.
24
- 25 15. A method of determining a location at a structure, which comprises:
26
27 providing a lighting infrastructure having transmitters each optically
28 transmitting a respective address;
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1 providing a list structure associating each address with a relative position
2 of a respective one of the transmitters with respect to a fixed
3 position;

4
5 detecting at least one of the transmitters with an optical receiver;

6
7 determining a position of the optical receiver relative to at least one of the
8 detected transmitters;

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10 determining a relative position of at least one of the detected transmitters
11 from the list structure; and

12
13 determining a relative position of the receiver from the relative position of
14 at least one of the detected transmitters.

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16 16. The method according to claim 15, which further comprises performing the step
17 of determining a relative position of at least one of the detected transmitters by:

18
19 determining an identity of at least one of the detected transmitters; and

20
21 selecting a corresponding relative position from the list structure.

22
23 17. The method according to claim 15, which further comprises modulating the
24 optical transmission of the respective address in emitted light with the transmitters
25 and performing the step of determining the relative position of at least one of the
26 detected transmitters by demodulating the respective address from the emitted
27 light with the receiver.

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- 1 18. The method according to claim 16, which further comprises modulating the
2 optical transmission of the respective address in emitted light with the transmitters
3 and performing the step of determining the identity by demodulating the
4 respective address from the emitted light with the receiver.
5
- 6 19. The method according to claim 15, which comprises optically transmitting a
7 respective unique address with each of the transmitters.
8
- 9 20. The method according to claim 15, which further comprises providing the list
10 structure as part of the receiver.
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- 12 21. The method according to claim 15, which further comprises locating the list
13 structure external to the receiver, and accessing the list structure with the receiver
14 through a transmission link.
15
- 16 22. The method according to claim 21, which further comprises:
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18 providing the list structure as part of a central computer system; and
19
20 performing the accessing step by accessing the list structure with the
21 receiver through at least one of the group consisting of a modem,
22 an RF link, an optical link, an acoustic link, an Internet connection,
23 a direct cellular link, the lighting infrastructure,
24 and a satellite link.
25
- 26 23. The method according to claim 15, which further comprises updating the list
27 structure to include information regarding additional transmitters added to the
28 infrastructure, to modify information regarding existing transmitters moved to a

1 new position, and to delete information regarding transmitters removed from the
2 infrastructure.

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4 24. The method according to claim 15, which further comprises performing the step
5 of determining a relative position of at least one of the detected transmitters by
6 performing a list structure lookup with a processor of the receiver.

7

8 25. The method according to claim 15, which further comprises performing the two
9 steps of determining a relative position by:

10

11 forwarding the position of the receiver relative to the detected transmitters
12 to a central station containing the list structure;

13

14 determining a relative position of at least one of the detected transmitters
15 from the list structure stored in the central station; and

16

17 determining a relative position of the receiver from the relative position of
18 at least one of the detected transmitters with the central station.

19

20 26. The method according to claim 25, which further comprises transmitting the
21 relative position of the receiver from the central station to the receiver.

22

23 27. A method of determining a location at a structure, which comprises:

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25 providing a lighting infrastructure at a structure, the infrastructure having
26 lights and transmitters connected to the lights for optically
27 transmitting a respective relative position of that transmitter with
28 respect to a fixed position through emitted light;

29

1 detecting the respective relative position of at least one of the transmitters
2 with an optical receiver; and
3
4 determining a relative position of the receiver from the detected relative
5 position by determining at least a two-dimensional position of the
6 receiver relative to at least one of the detected transmitters.

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8 28. A method of determining a location at a structure, which comprises:

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10 providing a lighting infrastructure having lights each optically transmitting
11 a respective unique address through emitted light at a structure
12 defining areas each having at least one of the lights;

13

14 detecting at least one of the lights with an optical receiver connected to a
15 list structure associating each address with a relative position of a
16 respective one of the lights with respect to a fixed position;

17

18 receiving the respective address of at least one of the detected lights with
19 the receiver and determining an identity of at least one of the
20 detected lights from the list structure;

21

22 performing a list structure lookup with a processor of the receiver to
23 determine a relative position of at least one of the detected lights;

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25 determining at least a two-dimensional position of the receiver relative to
26 at least one of the detected lights; and

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28 determining a relative position of the receiver from the relative position of
29 at least one of the detected lights.

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29. A method of determining a location at a structure, which comprises:
- providing a lighting infrastructure having transmitters each optically transmitting a respective address;
 - providing a list structure associating each address with an absolute terrestrial position of a respective one of the transmitters;
 - detecting at least one of the transmitters with an optical receiver;
 - determining a position of the receiver relative to at least one of the detected transmitters;
 - determining an absolute terrestrial position of at least one of the detected transmitters from the list structure; and
 - determining an absolute terrestrial position of the receiver from the absolute terrestrial position of at least one of the detected transmitters.
30. A method of determining a location at a structure, which comprises:
- providing a lighting infrastructure at a structure, the infrastructure having transmitters connected to lights optically transmitting a respective absolute terrestrial position of that transmitter through emitted light;

1 detecting the respective absolute terrestrial position of at least one of the
2 transmitters with an optical receiver; and

3
4 determining a relative position of the receiver from the detected absolute
5 terrestrial position by determining at least a two-dimensional
6 position of the receiver relative to at least one of the detected
7 transmitters.
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9 31. A method of determining a location at a structure, which comprises:

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11 providing a lighting infrastructure having lights each optically transmitting
12 a respective unique address through emitted light at a structure
13 defining areas each having at least one of the lights;
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15 detecting at least one of the lights with an optical receiver connected to a
16 list structure associating each address with an absolute terrestrial
17 position of a respective one of the lights;
18

19 receiving the respective address of at least one of the detected lights with
20 the receiver and determining an identity of at least one of the
21 detected lights from the list structure;
22

23 performing a list structure lookup with a processor of the receiver to
24 determine an absolute terrestrial position of at least one of the
25 detected lights;
26

27 determining at least a two-dimensional position of the receiver relative to
28 at least one of the detected lights; and
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- 1 determining an absolute terrestrial position of the receiver from the
2 absolute terrestrial position of at least one of the detected lights.
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- 4 32. A method of determining a location at a structure, which comprises:
5
6 providing a lighting infrastructure having transmitters each optically
7 transmitting a respective absolute terrestrial position of that
8 transmitter;
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10 detecting the respective absolute terrestrial position of at least one of the
11 transmitters with an optical receiver; and
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13 determining a absolute terrestrial position of the receiver from the detected
14 absolute terrestrial position.
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- 16 33. An optically-based location system, comprising:
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18 a lighting infrastructure having optical transmitters each configured to
19 illuminate and to transmit a respective relative position of said
20 transmitters with respect to a fixed position; and
21
22 an optical receiver configured to detect at least one of said transmitters and
23 to determine from the detection a relative position of said receiver.
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- 25 34. The system according to claim 33, wherein said lighting infrastructure is inside a
26 structure.
27
- 28 35. The system according to claim 33, wherein said transmitters are lights in said
29 lighting infrastructure.

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- 2 36. The system according to claim 33, wherein said lighting infrastructure includes
- 3 fluorescent lights each with a ballast, and each of said transmitters is part of a
- 4 ballast of said fluorescent lights.
- 5
- 6 37. The system according to claim 33, wherein said transmitters are configured to
- 7 transmit said respective relative position through emitted light.
- 8
- 9 38. The system according to claim 33, wherein said transmitters are configured to
- 10 transmit said respective relative position through modulation of emitted light and
- 11 said receiver is configured to demodulate said respective relative position from
- 12 the emitted light.
- 13
- 14 39. The system according to claim 33, wherein each of said transmitters is a
- 15 fluorescent light controlled by a unique ballast effecting a periodic transmission
- 16 of said respective relative position through emitted fluorescent light.
- 17
- 18 40. The system according to claim 39, wherein said unique ballast is configured to
- 19 control power supplied to said fluorescent light for varying illumination into a
- 20 form recognized by said receiver as said respective relative position.
- 21
- 22 41. The system according to claim 33, wherein said unique ballast is configured to
- 23 modulate illumination from said fluorescent light into a form recognized by said
- 24 receiver as said respective relative position.
- 25
- 26 42. The system according to claim 33, wherein said transmitters have a transmit
- 27 signal strength and said receiver has an optical power detector for detecting a
- 28 received signal strength and for comparing said received signal strength to said
- 29 transmit signal strength to form a distance measurement.

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2 43. The system according to claim 33, wherein said receiver is portable.

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4 44. The system according to claim 33, wherein said receiver is located in a device
5 selected from the group consisting of a piece of jewelry, a cellular telephone, and
6 a portable computing device.

7

8 45. The system according to claim 44, wherein said portable computing device is one
9 of the group consisting of a laptop computer and a personal digital assistant.

10

11 46. The system according to claim 33, including a display connected to said receiver
12 for showing a relative position of said receiver.

13

14 47. The system according to claim 33, wherein said receiver has a display for
15 showing a relative position of said receiver.

16

17 48. The system according to claim 33, wherein said receiver has at least one of the
18 group consisting of a silicon detector, a GaAs detector, a charged couple device
19 detector, and a charged couple device detector array.

20

21 49. The system according to claim 33, including a central station coupled to said
22 optical receiver, said central station configured to determine a relative position of
23 said optical receiver from at least one of said transmitters detected by said optical
24 receiver.

25

26 50. The system according to claim 49, wherein said central station is coupled to said
27 optical receiver through at least one of the group consisting of a modem, an RF
28 link, an optical link, an acoustic link, an Internet connection, a direct cellular link,
29 the lighting infrastructure, and a satellite link.

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51. An optically-based location system, comprising:
- a lighting infrastructure having optical transmitters each configured to illuminate and to transmit a respective address;
 - a list structure having a table associating each address of said transmitters with a relative position of each respective one of said transmitters with respect to a fixed position; and
 - an optical receiver configured to detect at least one of said transmitters and to determine from a detection a relative position of said receiver.
52. The system according to claim 51, wherein said receiver has a detector and a processor connected to said list structure and to said detector, said processor configured to determine a relative position of said receiver by executing the steps of:
- detecting at least one of said transmitters and a transmitted respective address of said at least one of said transmitters with said receiver;
 - determining a relative position of said receiver with respect to said at least one of said transmitters detected;
 - accessing said list structure with said processor using said addresses detected to obtain a relative position of said at least one of said transmitters stored in said list structure; and

1 correcting said relative position of said receiver using said relative
2 position of said at least one of said transmitters to obtain a relative
3 position of said receiver.
4

5 53. The system according to claim 51, wherein each of said transmitters is a
6 fluorescent light controlled by a unique ballast effecting a periodic transmission
7 of said address through emitted fluorescent light and said unique ballast controls
8 power supplied to said fluorescent light for varying illumination into a form
9 recognized by said receiver as said unique address.
10

11 54. The system according to claim 51, wherein said list structure is part of said
12 receiver.
13

14 55. The system according to claim 51, wherein said list structure is external to said
15 receiver and said receiver is coupled to said list structure through a transmission
16 link.
17

18 56. The system according to claim 55, including a central computer system hosting
19 said list structure, said transmission link including at least one of a modem, an
20 RIF link, an optical link, an acoustic link, an Internet connection, a direct cellular
21 link, the lighting infrastructure, and a satellite link.
22

23 57. The system according to claim 51, wherein said list structure is to be updated to
24 add information to said table regarding new transmitters added to said
25 infrastructure, to modify information in said table regarding existing transmitters
26 moved to a new position in said infrastructure, and to delete information in said
27 table regarding transmitters removed from said infrastructure.
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1 58. An optically-based location system, comprising:

2
3 a lighting infrastructure at a structure having lights each configured to
4 illuminate and to transmit a respective address through modulation
5 of emitted light;

6
7 a list structure having a table associating each address of said lights with a
8 relative position of each respective one of said lights; and

9
10 an optical receiver configured to detect at least one of said lights, to
11 demodulate said respective address from the emitted light, and to
12 determine from the detection a relative position of said receiver,
13 said receiver having a detector and a processor connected to said
14 list structure and to said detector, said processor configured to
15 determine a relative position of said receiver by executing the steps
16 of:

17
18 detecting at least one of said lights and a transmitted respective
19 address of said at least one of said lights with said receiver;

20
21 determining a relative position of said receiver with respect to said
22 at least one of said lights detected;

23
24 accessing said list structure with said processor using a detected
25 transmitted respective address to obtain a relative position of said
26 at least one of said lights stored in said list structure; and
27

1 correcting said relative position of said receiver using said relative
2 position of said at least one of said lights to obtain a relative
3 position of said receiver.

4 59. An optically-based location system, comprising:

5 a lighting infrastructure having optical transmitters each configured to
6 illuminate and to transmit a respective absolute terrestrial position
7 of said transmitters;

8 an optical receiver configured to detect at least one of said transmitters and
9 to determine from the detection an absolute terrestrial position of
10 said receiver.

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12 60. An optically-based location system, comprising:

13 a lighting infrastructure having optical transmitters each configured to
14 illuminate and to transmit a respective address;

15 a list structure having a table associating each address of said transmitters
16 with an absolute terrestrial position of each respective one of said
17 transmitters; and

18 an optical receiver configured to detect at least one of said transmitters and
19 to determine from a detection an absolute terrestrial position of
20 said receiver.

21

22 61. An optically-based location system, comprising:

23 a lighting infrastructure at a structure having lights each configured to
24 illuminate and to transmit a respective address through modulation
25 of emitted light;

26 a list structure having a table associating each address of said lights with
27 an absolute terrestrial position of each respective one of said lights;
28 and

1 an optical receiver configured to detect at least one of said lights, to
2 demodulate said respective address from the emitted light, and to
3 determine from the detection an absolute terrestrial position of said
4 receiver, said receiver having a detector and a processor connected
5 to said list structure and to said detector, said processor configured
6 to determine an absolute terrestrial position of said receiver by
7 executing the steps of:

8
9 detecting at least one of said lights and a transmitted respective address of
10 said at least one of said lights with said receiver;
11 determining a relative position of said receiver with respect to said at least
12 one of said lights detected;
13 accessing said list structure with said processor using a detected
14 transmitted respective address to obtain an absolute terrestrial
15 position of said at least one of said lights stored in said list
16 structure; and
17 correcting said relative position of said receiver using said absolute
18 terrestrial position of said at least one of said lights to obtain an
19 absolute terrestrial position of said receiver.
20

21 62. An optically-based in-building location system, comprising:

22 a lighting infrastructure having optical transmitters each configured to
23 illuminate and to transmit a respective address signal; and
24 an optical receiver configured to:
25 decode the respective address of at least one of said transmitters,
26 determine one of a distance and a position relative to said at least one
27 transmitter from one or more measurements of the address signal,
28 and

1 transmit a position signal that includes the determined distance or relative
2 position.
3

4 63. The system according to claim 62, further comprising a central receiver control
5 station that receives the position signal and determines one of the absolute
6 terrestrial position, or a position relative to another coordinate system.
7

8 64. The method of claim 8 wherein at least one of the lights comprises a visible light
9 assembly that emits visible light capable of providing illumination and
10 electronically detectable variations, the variations resulting from data
11 transmission and being imperceptible to the human eye.
12

13 65. The method of claim 15 wherein at least one of the lights comprises a visible light
14 assembly that emits visible light capable of providing illumination and
15 electronically detectable variations, the variations resulting from data
16 transmission and being imperceptible to the human eye.
17

18 66. The method of claim 27 wherein at least one of the lights comprises a visible light
19 assembly that emits visible light capable of providing illumination and
20 electronically detectable variations, the variations resulting from data
21 transmission and being imperceptible to the human eye.
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23 67. The method of claim 28 wherein at least one of the lights comprises a visible light
24 assembly that emits visible light capable of providing illumination and
25 electronically detectable variations, the variations resulting from data
26 transmission and being imperceptible to the human eye.

- 1 68. The method of claim 29 wherein at least one of the lights comprises a visible light
2 assembly that emits visible light capable of providing illumination and
3 electronically detectable variations, the variations resulting from data
4 transmission and being imperceptible to the human eye.
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- 6 69. The method of claim 30 wherein at least one of the lights comprises a visible light
7 assembly that emits visible light capable of providing illumination and
8 electronically detectable variations, the variations resulting from data
9 transmission and being imperceptible to the human eye.
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- 11 70. The method of claim 31 wherein at least one of the lights comprises a visible light
12 assembly that emits visible light capable of providing illumination and
13 electronically detectable variations, the variations resulting from data
14 transmission and being imperceptible to the human eye.
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- 16 71. The method of claim 32 wherein at least one of the lights comprises a visible light
17 assembly that emits visible light capable of providing illumination and
18 electronically detectable variations, the variations resulting from data
19 transmission and being imperceptible to the human eye.
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- 21 72. The system of claim 33 wherein at least one of the lights comprises a visible light
22 assembly that emits visible light capable of providing illumination and
23 electronically detectable variations, the variations resulting from data
24 transmission and being imperceptible to the human eye.
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1 73. The system of claim 51 wherein at least one of the lights comprises a visible light
2 assembly that emits visible light capable of providing illumination and
3 electronically detectable variations, the variations resulting from data
4 transmission and being imperceptible to the human eye.

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6 74. The system of claim 58 wherein at least one of the lights comprises a visible light
7 assembly that emits visible light capable of providing illumination and
8 electronically detectable variations, the variations resulting from data
9 transmission and being imperceptible to the human eye.

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11 75. The system of claim 59 wherein at least one of the lights comprises a visible light
12 assembly that emits visible light capable of providing illumination and
13 electronically detectable variations, the variations resulting from data
14 transmission and being imperceptible to the human eye.

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16 76. The system of claim 60 wherein at least one of the lights comprises a visible light
17 assembly that emits visible light capable of providing illumination and
18 electronically detectable variations, the variations resulting from data
19 transmission and being imperceptible to the human eye.

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21 77. The system of claim 61 wherein at least one of the lights comprises a visible light
22 assembly that emits visible light capable of providing illumination and
23 electronically detectable variations, the variations resulting from data
24 transmission and being imperceptible to the human eye.

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- 1 78. The system of claim 62 wherein at least one of the lights comprises a visible light
2 assembly that emits visible light capable of providing illumination and
3 electronically detectable variations, the variations resulting from data
4 transmission and being imperceptible to the human eye.
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- 6 79. The system of claim 63 wherein at least one of the lights comprises a visible light
7 assembly that emits visible light capable of providing illumination and
8 electronically detectable variations, the variations resulting from data
9 transmission and being imperceptible to the human eye.
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